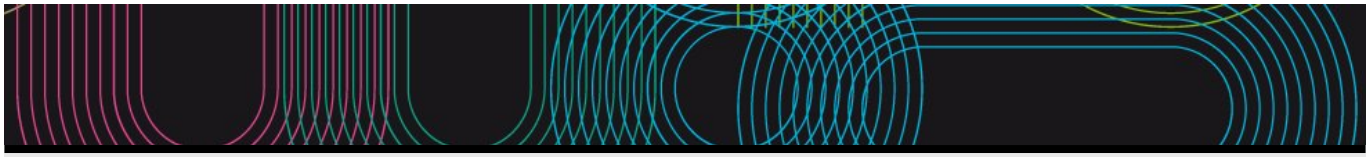

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Physics: Fundamentals of Mechanics and Thermodynamics** | | | | |
| Subject | Physics: Fundamentals of Mechanics and Thermodynamics | | | |
| Code | V05G300V01102 | | | |
| Study programme | Degree in Telecommunications Technologies Engineering | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Basic education | 1st | 1st |
| Teaching language | Spanish | | | |
| Department | | | | |
| Coordinator | Chiussi , Stefano | | | |
| Lecturers | Boutinguiza Larosi, Mohamed<br>Chiussi , Stefano<br>Fernández Doval, Ángel Manuel | | | |
| E-mail | schiussi@uvigo.es | | | |
| Web | http://faitic.uvigo.es | | | |
| General description | Introduction to the basic concepts on the general laws of Mechanics and Thermodynamics as well as to their application to the resolution of problems in engineering. | | | |

| Competencies | |
|---|---|
| Code | |
| B3 | CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations |
| B5 | CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area. |
| B6 | CG6: The aptitude to manage mandatory specifications, procedures and laws. |
| C3 | CE3/FB3: Comprehension and command of basic concepts about the general laws of mechanics, thermodynamics, electromagnetic fields and waves and electromagnetism and their application to solve Engineering problems. |
| D3 | CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc. |

| Learning outcomes | | | |
|---|---|---|---|
| Expected results from this subject | Training and Learning Results | | |
| Understanding and mastering of the basic concepts on the general laws of Mechanics and Thermodynamics. | B3 | C3 | |
| Ability to use the basic instrumentation to measure physical quantities. | B3<br>B5<br>B6 | C3 | D3 |
| Ability to evaluate experimental data. | B3<br>B5 | C3 | |
| Ability to solve the elementary technical problems in engineering. | B3 | C3 | |

| Contents |
|---|
| Topic |
| 1.- Physical quantities and units. The International System. |
| 2.- Vectorial tools for Mechanics. |

| |
|---|
| 3.- Point Kinematics. |
| 4.- Point Kinetics. |
| 5.- Statics. |
| 6.- Oscillations. |
| 7.- Wave motion. |
| 8.- Zero principle of Thermodynamics. Temperature. |
| 9.- First principle of Thermodynamics. |
| 10.- Second principle of Thermodynamics. |
| Lab 1.- Measurement instruments. Error and uncertainty. Estimation of uncertainties in direct measurements. |
| Lab 2.- Measurement of the reaction time to a given stimulus. Measurement of the gravitational acceleration by means of a pendulum. Estimation of uncertainty in indirect measurements. |
| Lab 3.- Verification of Hooke's Law. Linear fit. |
| Lab 4.- Longitudinal and transversal standing waves. Measurements by linearization of non-linear relations and linear fit. Graphical representation of measurement results. |
| Lab 5.- Simple harmonic motion. Free standing oscillation of a spring. Measurements by linearization of non-linear relations and linear fit. Graphical representation of measurement results. |

**Planning**

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Master Session | 22 | 22 | 44 |
| Case studies / analysis of situations | 6 | 12 | 18 |
| Troubleshooting and / or exercises | 15.5 | 46.5 | 62 |
| Laboratory practises | 9 | 13.5 | 22.5 |
| Multiple choice tests | 0.5 | 0 | 0.5 |
| Short answer tests | 1 | 0 | 1 |
| Practical tests, real task execution and / or simulated. | 2 | 0 | 2 |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

**Methodologies**

| | Description |
|---|---|
| Master Session | Prior personal work:<br>-Preliminary reading of the proposed bibliography on the subject.<br>During the lectures:<br>-Presentation of theoretical concepts.<br>-Experimental demonstrations.<br>-Audiovisual presentations.<br>Ulterior personal work:<br>-Revision of theoretical concepts.<br>-Weak-point identification.<br>-Consult the bibliography.<br><br>Through this methodology, competencies CG3, CE3, CG5, CG6 are worked out. |
| Case studies / analysis of situations | Application of the theoretical concepts to simple cases and situations.<br>During the lectures:<br>-Solving of examples.<br>Ulterior personal work:<br>-Solving of cases and situations from the bibliography.<br>-Identification of weak points which require tutorial aid.<br><br>Through this methodology, competencies CG3, CE3, CG5, CG6 are worked out. |

| | |
|---|---|
| Troubleshooting and / or exercises | Solving of average-difficulty problems involving one or more theoretical concepts.<br>During the lectures:<br>-Presentation of solving strategies and techniques by solving example-problems.<br>Personal work:<br>-Solving of problems from the bibliography.<br>-Identification of weak points which require tutorial aid.<br><br>Through this methodology, competencies CG3, CE3, CG5, CG6 are worked out. |
| Laboratory practises | Prior personal work:<br>-Preparation of the practical session by studying the corresponding guide and reviewing the theory.<br>During the practical session:<br>-Description of the experiment highlighting which theoretical concepts are involved.<br>-Training on material and instrumentation handling.<br>-Execution of the experiment.<br>-Preliminary result processing.<br>Ulterior personal work:<br>-Processing and analysis of the results.<br>-Weak-point identification.<br>-Consult the bibliography.<br><br>Through this methodology, competencies CG3, CE3, CG5, CG6 and CT3 are worked out. |

**Personalized attention**

| Methodologies | Description |
|---|---|
| Master Session | Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail or in person at the beginning or end of a lecture. |
| Case studies / analysis of situations | Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail or in person at the beginning or end of a lecture. |
| Troubleshooting and / or exercises | Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail or in person at the beginning or end of a lecture. |
| Laboratory practises | Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail or in person at the beginning or end of a lecture. |

**Assessment**

| | Description | Qualification | Training and Learning Results | |
|---|---|---|---|---|
| Multiple choice tests | Multiple-choice questions about theoretical concepts. Solving of elementary cases and situations related to the topics in both the classroom and laboratory syllabi. | 25 | B3<br>B5<br>B6 | C3 |
| Short answer tests | Short answer questions about theoretical concepts. Solving of elementary cases and situations related to the topics in both the classroom and laboratory syllabi. | 25 | B3<br>B5<br>B6 | C3 |
| Practical tests, real task execution and / or simulated. | Practical tests: Solving of problems involving one or more theoretical topics. Execution of real and simulated measurements. Real- and simulated-measurement result processing. | 50 | B3<br>B5<br>B6 | C3 |

**Other comments on the Evaluation**

(This is a translation, in case of any discrepancy or dispute, the original Spanish version shall prevail.)

Following the particular guidelines of this degree, the students taking this subject will be offered two alternative assessment systems: continuous assessment and single end-of-semester assessment.

It will be assumed that a student chooses continuous assessment if he or she takes and hands the third assessment exercise in (see below) and that he or she chooses single end-of-semester assessment if he or she does not hand the aforementioned exercise in. Once the results of this exercise are handed in, it will be understood that the student has taken the current term's examination call and he or she will be qualified according to the following criterion, regardless of whether he or she takes the final test or not.

1) CONTINUOUS ASSESSMENT

Continuous assessment consists of the exercises detailed below in this guide which are not retakeable, i.e, if a student is not able to take them in the scheduled date the teaching staff will not be required to repeat them.

As a general rule, the marks of each exercise will be published before the next one. The marked exercises may be revised, during the tutorial-aid hours of the corresponding lecturer , along the fourteen days following the publication date of the marks.

The marks obtained in the tests will be only valid for the academic term they have been obtained.

First assessment exercise:

a1) Experimental laboratory exercise comprising the execution of actual measurements and the processing of the results, consisting in taking the experimental laboratory class number 3, individually processing (during the last 30 minutes) the assessable results specified in the corresponding experiment guide and handing them in at the end of the class (mark: between 0 and 1 point).

Second assessment exercise:

b1) Combined test with multiple-choice and short-answer questions and exercises. Questions about theoretical concepts. Solving of elementary cases and situations related to the topics in the classroom syllabus (mark: between 0 and 1 point).

Length: 30 minutes during one of the theory or problem-solving lectures. Its date will appear in the assessment test schedule that the Academic Board of the Degree will approve.

Third assessment exercise:

c1) Experimental laboratory exercise comprising the execution of actual measurements and the processing of the results, consisting in taking the experimental laboratory class number 5, individually processing (during the last 30 minutes) the assessable results specified in the corresponding experiment guide and handing them in at the end of the class (mark: between 0 and 1 point).

Fourth exercise, continuous assessment final test:

Combined test with:

d1) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e1) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f1) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official examination date.

Overall mark calculation.

g1) will be calculated as the sum of the marks obtained in blocks b1), d1) and e1) plus the lowest of 2 points and the sum of blocks a1), c1) and f1)

$g1 = b1 + d1 + e1 + \min\{ 2 , a1 + c1 + f1 \}$

The overall mark will be the lowest of 10 points or g1)

$\text{overall mark} = \min\{ 10, g1 \}$

2) SINGLE END-OF-SEMESTER ASSESSMENT

Final overall test:

Combined test with:

d2) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e2) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f2) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official examination date.

Overall mark calculation:

g2) will be calculated as the sum of the marks obtained in blocks d2), e2) and f2)

g2 = d2 + e2 + f2

The overall mark will be g2)

overall mark = g2

3) RESIT

Resit exam:

Combined test with:

d3) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e3) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f3) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official resit date.

Final mark calculation:

The students who did not pass the subject and attend the resit exam will obtain a mark according to the following criteria:

3A) Students who had chosen continuous assessment

g3A) will be calculated as the sum of the marks obtained in blocks b1), d3) and e3) plus the lowest of 2 points and the sum of blocks a1), c1) and f3)

g3A = b1 + d3 + e3 + min{ 2 , a1 + c1 + f3 }

The overall mark will be the lowest of 10 points or g3A)

overall mark = min{ 10, g3A }

3B) Students who had chosen end-of-semester assessment

g3B) will be calculated as the sum of the marks obtained in blocks d3), e3) and f3)

g3B = d3 + e3 + f3

The overall mark will be g3B)

overall mark = g3B

NOTES:

I) All of the aforesaid calculations will be performed with a resolution equal to or better than one hundredth of a point (0,01 point).

II) The overall marks will be rounded to the nearest multiple of 0,1 point (one tenth of a point); if the two nearest multiples of 0,1 point are equidistant, the overall mark will be rounded to the higher of them.

III) The mark scale is established on the understanding that the minimum overall mark necessary to pass the subject is 5,0 points.

## Sources of information

### Basic Bibliography


H.D. Young y R.A. Freedman, **Sears-Zemansky. Física Universitaria**, 9, 11, 12 o 13, Addison-Wesley,

Profesorado presente y pasado de la asignatura., **Guiones de las prácticas de «Física Fundamentos de Mecánica y Termodinámica»**, 2017-2018, 2017

Oficina Internacional de Pesas y Medidas (BIPM), **Sistema Internacional de Unidades SI**, 8, Centro Español de Metrología, 2008


### Complementary Bibliography


I.N. Bronshtein, K.A. Semendiaev, **Manual de Matemáticas para Ingenieros y Estudiantes**, (cualquier edición), MIR,

Raymond A. Serway, John W. Jewett, **Física, Tomo 1**, 3, Thomson, 2003

Paul A. Tipler, **Física, Tomo 1**, 5, Reverté, 2005

W. Edward Gettys, et al., **Física Clásica y Moderna**, Mc Graw-Hill, 1991

Douglas C. Giancoli, **Física para universitarios, Tomo 1**, 3, Prentice-Hall, 2002

Marcelo Alonso, Edward J. Finn, **Física**, Addison-Wesley, 1995

Susan M. Lea, John R. Burke, **Física. La naturaleza de las cosas, Tomo 1**, Paraninfo, 2001

Ambler Thompson, Barry N. Taylor, **NIST Special Publication 811, «Guide for the Use of the International System of Units (SI)»**, 2008, Narional Institute of Standards and Technology, 2008

Comité Conjunto para las Guías en Metrología (JCGM), **Vocabulario Internacional de Metrología VIM**, 3, Centro Español de Metrología, 2012


## Recommendations

### Subjects that continue the syllabus

Fundamentals of Sound and Image/V05G300V01405

Power Electronics/V05G300V01625

Fundamentals of Acoustics Engineering/V05G300V01531

### Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G300V01104

Mathematics: Calculus 1/V05G300V01105

### Other comments

To adequately follow this subject, it is highly advisable to master the contents of high-school subjects on Mathematics and Physics.