



## IDENTIFYING DATA

### Physics: Fundamentals of Mechanics and Thermodynamics

Subject	Physics: Fundamentals of Mechanics and Thermodynamics			
Code	V05G306V01103			
Study programme	Bachelor Degree in Telecommunication Technologies Engineering (BTTE)			
Descriptors	ECTS Credits 6	Choose Basic education	Year 1st	Quadmester 1st
Teaching language	English			
Department				
Coordinator	Chiussi , Stefano			
Lecturers	Chiussi , Stefano Fernández Doval, Ángel Manuel			
E-mail	schiussi@uvigo.es			
Web	http://moovi.uvigo.gal			
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.			

"English Friendly" subject. International students may request from the lecturers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) tests and assessments in English.

## Training and Learning Results

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.		

## Expected results from this subject

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

## Contents

Topic	
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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
Lecturing	28	34	62
Problem solving	21	40	61
Laboratory practical	9	13	22
Essay questions exam	0.5	0	0.5
Problem and/or exercise solving	3.5	0	3.5
Report of practices, practicum and external practices 1		0	1

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Lecturing	<p>Prior personal work:</p> <ul style="list-style-type: none"><li>-Preliminary reading of the proposed bibliography on the subject.</li></ul> <p>During the lectures:</p> <ul style="list-style-type: none"><li>-Presentation of theoretical concepts.</li><li>-Application of the theoretical concepts to simple cases and situations.</li><li>-Experimental demonstrations.</li><li>-Audiovisual presentations.</li></ul> <p>Ulterior personal work:</p> <ul style="list-style-type: none"><li>-Revision of theoretical concepts.</li><li>-Solving of questions and exercises from the bibliography.</li><li>-Consult the bibliography.</li><li>-Identification of weak points which require tutorial aid.</li></ul> <p>Through this methodology, competencies B3, C3, B5, B6 are worked out.</p>

Problem solving	<p>Solving of average-difficulty problems involving one or more theoretical concepts.</p> <p>During the lectures:</p> <ul style="list-style-type: none"> <li>-Presentation of solving strategies and techniques by solving example-problems.</li> </ul> <p>Personal work:</p> <ul style="list-style-type: none"> <li>-Solving of problems from the bibliography.</li> <li>-Identification of weak points which require tutorial aid.</li> </ul> <p>Through this methodology, competencies B3, C3, B5, B6 are worked out.</p>
Laboratory practical	<p>Prior personal work:</p> <ul style="list-style-type: none"> <li>-Preparation of the practical session by studying the corresponding guide and reviewing the theory.</li> </ul> <p>During the practical session:</p> <ul style="list-style-type: none"> <li>-Description of the experiment highlighting which theoretical concepts are involved.</li> <li>-Training on material and instrumentation handling.</li> <li>-Execution of the experiment.</li> <li>-Preliminary result processing.</li> </ul> <p>Ulterior personal work:</p> <ul style="list-style-type: none"> <li>-Processing and analysis of the results.</li> <li>-Weak-point identification.</li> <li>-Consult the bibliography.</li> </ul> <p>Through this methodology, competencies B3, C3, B5, B6 and D3 are worked out.</p>

### Personalized assistance

Methodologies	Description
Lecturing	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutoring sessions will be held: 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 (see <a href="https://moovi.uvigo.gal">https://moovi.uvigo.gal</a> ) or in person at the beginning or end of a lecture.
Problem solving	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutoring sessions will be held: 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 (see <a href="https://moovi.uvigo.gal">https://moovi.uvigo.gal</a> ) or in person at the beginning or end of a lecture.
Laboratory practical	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutoring sessions will be held: 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 (see <a href="https://moovi.uvigo.gal">https://moovi.uvigo.gal</a> ) or in person at the beginning or end of a lecture.

### Assessment

	Description	Qualification	Training and Learning Results
Essay questions exam	Solving of questions related to the theoretical concepts of the topics in both the classroom and laboratory syllabi.	10	B3 B5 B6
Problem and/or exercise solving	(Problem solving) Solving of simple exercises related to the theoretical concepts of the topics in the syllabus. Solving of problems involving one or more theoretical topics.	70	B3 C3 B5 B6
Report of practices, practicum and external practices	Execution of real and simulated measurements. Real- and simulated-measurement result processing.	20	B3 D3 B5 B6

### Other comments on the Evaluation

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

The common assessment and grading rules of the University of Vigo are established in:

[RAUV] [Regulamento sobre a avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do estudantado] (available only in Galician language at <https://secretaria.uvigo.gal/uv/web/normativa/public/show/565>).

## 1. CHOICE OF THE ASSESSMENT SYSTEM

Each student can choose the system by which he or she will be assessed. [RAUV Art.19]

- CONTINUOUS ASSESSMENT is chosen if the results of the practical laboratory exercise LC2 are handed in.

Once the results of this exercise have been handed in, it will be understood that the student has taken the current term's examination call and the grade resulting from the application of the criteria detailed in §3.1.1 will be assigned in the ordinary assessment opportunity, regardless of whether or not he or she takes the remaining tests.

- The OVERALL ASSESSMENT is chosen if the results of the practical laboratory exercise LC2 are not handed in.

By opting for the overall assessment, all the marks obtained in the continuous assessment tests are waived. [RAUV Art.19.4]

## 2. ASSESSMENT TESTS

Each student summoned to an assessment test must appear with an original official document proving their identity (DNI, NIE, passport, university card or Spanish driving licence). [RAUV Art.28.4].

In the event that a fraudulent action is detected in the performance or revision of any of the assessment tests (copying, plagiarism, impersonation, introduction or use of means not permitted by the rules and instructions of the exercises and assessment tests, alteration, subtraction or destruction of the same, etc.) [RAUV Art.42]:

- The person(s) involved shall be identified and immediately expelled from the assessment test.

- A final grade of zero points (fail) will be assigned to the person(s) involved.

- A report will be submitted to the school management for disciplinary action to be taken.

### 2.1. CONTINUOUS ASSESSMENT

The grade obtained in the continuous assessment tests will only be valid for the two assessment opportunities of the ordinary call of the academic year in which they are taken.

#### 2.1.1. INTERMEDIATE CONTINUOUS ASSESSMENT TESTS

The schedule of the intermediate assessment tests will be made available by the beginning of the semester in which this subject is taught. These intermediate tests are not recoverable, i.e., they can be only taken in the scheduled dates.

The corrected exercises may be revised, by requesting a tutoring session from the corresponding lecturer, during the fourteen days following the date of publication of the marks.

There will be four intermediate tests:

LC1 and LC2) Experimental laboratory exercises comprising the execution of actual measurements and the processing of the results, consisting in taking an experimental laboratory class, individually processing (during the last 30 minutes) the assessable results which will be specified in the corresponding experiments guide and handing them in at the end of the class (marks LC1 and LC2 between 0 and 1 point for each of the exercises).

EC1 and EC2) Written exams with questions, exercises and problems (marks EC1 and EC2 between 0 and 2,5 points for each exam). Duration: one lecture on theory or problems (nominally 1 hour).

The assessment tests that the student has not taken will be graded with 0 (zero points).

#### 2.1.2. FINAL CONTINUOUS ASSESSMENT TEST OF THE ORDINARY OPPORTUNITY

EC3) Written exam with questions, exercises and problems (mark EC3 between 0 and 4 points). Duration 2 hours on the date officially assigned for the subject in the examinations schedule of the Centre.

#### 2.1.3. FINAL CONTINUOUS ASSESSMENT TEST OF THE EXTRAORDINARY ASSESSMENT OPPORTUNITY

Written resit exam with three optional parts:

E12R) Questions, exercises and problems corresponding to the contents of EC1 and EC2 (mark E12R between 0 and 4 points). If this part is not handed in, the E12R mark will be assigned the sum of the EC1 and EC2 marks.

E3R) Questions, exercises and problems corresponding to the contents of EC3 (E3R mark between 0 and 4 points). If this part is not handed in, the E3R mark will be assigned the mark obtained in EC3.

LR) Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LR mark between 0 and 2 points). the LR mark will be assigned the sum of the LC1 and LC2 marks.

Duration 4 hours on the date officially assigned for the subject in the examinations schedule of the Centre.

## 2.2. OVERALL ASSESSMENT

### 2.2.1. FINAL OVERALL ASSESSMENT TEST OF THE ORDINARY OPPORTUNITY

Written exam with three parts:

E12F) Questions, exercises and problems corresponding to the contents of EC1 and EC2 (E12F mark between 0 and 4 points).

E3F) Questions, exercises and problems corresponding to the contents of EC3 (E3F mark between 0 and 4 points).

LF) Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LF mark between 0 and 2 points).

The parts of the exam that the student does not hand in will be marked with 0 (zero points).

Duration 4 hours on the date officially assigned for the subject in the examinations schedule of the Centre.

### 2.2.2. FINAL OVERALL ASSESSMENT TEST OF THE EXTRAORDINARY OPPORTUNITY

Written exam with three parts:

E12R) Questions, exercises and problems corresponding to the contents of EC1 and EC2 (E12R mark between 0 and 4 points).

E3R) Questions, exercises and problems corresponding to the contents of EC3 (E3R mark between 0 and 4 points).

LR) Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LR score between 0 and 2 points).

Duration 4 hours on the date officially assigned for the subject in the in the examinations schedule of the Centre.

The parts of the exam that the student does not hand in will be graded with 0 (zero points).

## 2.3. END-OF-STUDIES CALL

### 2.3.1. ASSESSMENT TEST OF THE END-OF-STUDIES CALL

Written exam with three parts:

E12E) Questions, exercises and problems corresponding to the contents of EC1 and EC2 (E12E mark between 0 and 4 points).

E3E) Questions, exercises and problems corresponding to the contents of EC3 (E3E mark between 0 and 4 points).

LE) Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LE mark between 0 and 2 points).

Duration 4 hours on the date officially assigned for the subject in the examinations schedule of the Centre.

The parts of the exam that the student does not hand in will be graded with 0 (zero points).

## 3. FINAL GRADING

### 3.1. CONTINUOUS ASSESSMENT

#### 3.1.1. ORDINARY ASSESSMENT OPPORTUNITY

A combined mark CCF will be calculated as the sum of the marks of the continuous assessment tests (§2.1.1 and §2.1.2).

The final grade FINAL\_F will be the lower of 10 points and CCF.

$CCF = EC1 + EC2 + EC3 + LC1 + LC2$

$$\text{FINAL\_F} = \min\{\text{CCF}, 10\}$$

### 3.1.2. EXTRAORDINARY ASSESSMENT OPPORTUNITY

A combined mark CCR will be calculated as the sum of the marks of the three parts of the resit examination (§2.1.3).

The final grade FINAL\_R will be the lower of 10 points and CCR.

$$\text{CCR} = \text{E12R} + \text{E3R} + \text{LR}, 10$$

$$\text{FINAL\_R} = \min\{\text{CCR}, 10\}$$

Note: as indicated in §2.1.3

- if the E12R part of the resit examination is not handed in,  $\text{E12R} = \text{EC1} + \text{EC2}$

- if the E3R part of the resit examination is not handed in,  $\text{E3R} = \text{EC3}$

- if the LR part of the resit examination is not handed in,  $\text{LR} = \text{LC1} + \text{LC2}$

### 3.2. OVERALL ASSESSMENT

#### 3.2.1. ORDINARY ASSESSMENT OPPORTUNITY

The final grade FINAL\_F will be calculated as the sum of the marks of the three parts of the examination (§2.2.1).

$$\text{FINAL\_F} = \text{E12F} + \text{E3F} + \text{LF}$$

#### 3.2.2. EXTRAORDINARY ASSESSMENT OPPORTUNITY

The final grade FINAL\_R will be calculated as the sum of the marks of the three parts of the examination (§2.2.2).

$$\text{FINAL\_R} = \text{E12R} + \text{E3R} + \text{LR}$$

### 3.3. END-OF-STUDIES CALL GRADING

The final grade FINAL\_E will be calculated as the sum of the marks of the three parts of the examination (§2.3.1).

$$\text{FINAL\_E} = \text{E12E} + \text{E3E} + \text{LE}$$

### 4. CALCULATIONS AND ROUNDING:

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

II) The final 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 grade will be rounded to the higher of them.

III) The minimum final grade required to pass the course is 5,0 points. [RAUV Art.31]

### Sources of information

#### Basic Bibliography

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

H.D. Young y R.A. Freedman, **University Physics**, 9, 11, 12 or 13, Addison-Wesley,

Present and past lecturers of this subject, **Laboratory Notes for the practical sessions of**, 2023-2024, 2023

Profesorado presente y pasado de la asignatura., **Guiones de las prácticas de «Física Fundamentos de Mecánica y Termodinámica»**, 2022-2024, 2023

Bureau Internationale des Poids et Mesures (BIPM), **SI Brochure: The International System of Units (SI)**, 9, Bureau Internationale des Poids et Mesures (BIPM), 2019

Oficina Internacional de Pesas y Medidas (BIPM), **Sistema Internacional de Unidades SI**, 9, Centro Español de Metrología, 2019

#### 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, National 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

Joint Committee for Guides in Metrology (JCGM), **International vocabulary of metrology (VIM)**, 3, Bureau International des Poids et Mesures, 2012

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## Recommendations

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### Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G301V01102

Mathematics: Calculus 1/V05G301V01101

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### Other comments

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