Universitat de Lleida

DEGREE CURRICULUM

PHYSICS I

Coordination: BADIA PASCUAL, FERNANDO

Academic year 2023-24

PHYSICS I 2023-24

Subject's general information

Subject name	PHYSICS I
Code	102104
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Automation and Industrial Electronic Engineering	1	COMMON/CORE	Attendance-based
Bachelor's Degree in Energy and Sustainability Engineering	1	COMMON/CORE	Attendance-based
Bachelor's Degree in Mechanical Engineering	1	COMMON/CORE	Attendance-based
Common branch in industrial engineering programs - Lleida	1	COMMON/CORE	Attendance-based
Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering	1	COMMON/CORE	Attendance-based
Programa Acadèmic de Recorregut Successiu - Enginyeries Industrials	1	COMMON/CORE	Attendance-based

Course number of credits (ECTS)	6

Type of activity, credits, and groups

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.4	2.6	3
Number of groups	12	4	3

Coordination	BADIA PASCUAL, FERNANDO
Department	ENVIRONMENT AND SOIL SCIENCES AND CHEMISTRY
Important information on data processing	Consult this link for more information.
Language	Catalan

PHYSICS I 2023-24

Distribution of credits	Ferran Badia 6 Jordi Barrufet Barque 3 Francesc Perello Sans 2,4 Joan Ignasi Rosell Urrutia 6 Miquel Carrera 3

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
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Subject's extra information

SECURITY RULES IN THE LABORATORY

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:
C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera
http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI. Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the consequences in the evaluation of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.

• Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
• No food or drink is allowed in the laboratory.
• It is forbidden to smoke in the laboratories.
• Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
• Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the Servei de Prevenció de Riscos Laborals de la UdL: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

General Objectives

Acquire basic knowledge about the concepts and methods of General Physics . This knowledge implies both theoretical and practical knowledge. Theoretical knowledge is necessary to understand the concepts and laws of physics , allowing as well to know how to use the language of physics . Practical knowledge must provide a domain in solving problems of physics.

- To properly use the units system.
- To learn how to think in a scientific and technical context.
- To Properly argue a conclusion based on some assumptions .
- To acquire a sufficient basis to be able to deal with later subjects based on the application of the laws of classical physics .

Physicists are renowned for the power of their problem-solving capabilities. Great emphasis and effort is spent providing students with tools and methods to approach and solve increasingly challenging problems. We hope that these challenges will not only broaden and deepen students' skills but will amplify their drive to participate in discovery.

Essential Science and Mathematical Skills
Students should be able to solve complex and diverse problems by:

- recognizing universal physical laws relevant to the problem,
- applying the relevant laws to the problem,
- applying mathematical and computational techniques,
- using experimental, computational, and/or theoretical methods, and
- evaluating the limitations of their solutions.

Success in just about any environment also requires attention to professional and interpersonal skills reflected in the outcomes below. These skills balance, complement, and strengthen student core science and mathematical skills.

Core Professional Skills
Students should be able to:

- Critically assess their current state of knowledge and expertise, and develop, implement, and refine a plan to acquire new knowledge for specific scientific goals and in pursuit of new intellectual interests
- Communicate effectively via oral, visual, and written formats to diverse STEM audiences.
- Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources.

Competences

Degree-specific competences

- GEM 2 GEEIA2. Understanding and commanding basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems in

engineering..

Degree-transversal competences

- EPS1. Capacity to solve problems and prepare and defence arguments inside the area of studies.
- EPS5. Capacity of abstraction and of critical, logical and mathematical thinking.
- EPS6. Capacity of analysis and synthesis.
- EPS8. Capacity of planning and organizing the personal work.

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Subject contents

1. Physical Quantities

1.1 The concept of physical magnitude

1.2 Structure and Types

1.3 Systems units: International System

1.4 Dimensional Analysis

1.5 Changes of units

1.6 Orders of magnitude

1.7 Significant Figures

2. Motion in one dimension. Rectilinear motion

2.1 Position, displacement, velocity and speed

2.2 Instantaneous Speed and Velocity

2.3 Constant Acceleration

2.4 Free falling of bodies

3. Motion in two dimensions. Motion in a plane

3.1 Position in the plane: Coordinate

3.2 Position, velocity and acceleration vectors: components

3.3 Constant acceleration in the plane

3.4 Parabolic motion

3.5 Circular motion: normal and tangential acceleration

3.6 Relative velocity ??and acceleration

4. Laws of Motion

4.1 The concept of force

4.2 Newton's first law: Inertia

4.3 Newton's second law

4.4 Newton's Third Law

4.5 Momentum and mechanical impulse

4.6 Applications of Newton's laws

4.6.1 Gravity and normal force

4.6.2 Friction

4.6.3 Contact Forces

4.6.4 Tensions

4.6.5 Restoring Forces

4.6.6 Hooke's law

4.6.7 Drag Forces: motion in fluids

4.6.8 Accelerated reference systems: fictitious forces

5. Work and Energy

5.1 System and environment

5.2 The concept of mechanical work

5.3 Work with non constant forces

5.4 Work-energy theorem: kinetic energy

5.5 Power

5.6 Potential energy and conservative forces

5.7 Energy Conservation

5.8 Other forms of energy

6. Many-Particle Systems

6.1 Collisions between particles

6.2 Centre of mass

6.3 Movement of a many-particle system

6.4 Variable mass: jet propulsion

7. Rigid systems

7.1 Mass Distributions

7.2 Traslation of a rigid body

7.3 Rotation around a fix shaft

7.3.1 Kinetic energy of rotation

7.3.2 Moment of inertia

7.3.3 Torque

7.3.4 Work, energy and power in rotation

7.4 Rotation and traslation motion

8. Angular momentum

8.1 Angular momentum of a rigid body

8.2 Conservation of angular momentum

8.3 General motion of a solid

9. Solid Statics

9.1 Equilibrium and static equilibrium

9.2 Center of Gravity

9.3 Elastic properties of solids

Methodology

The development of the subject is done based on 3 actions:
1) Classes "Theory"

Exposition of the concepts, principles and fundamental relationships of each topic. In the classes of "theory" the most important concepts of each subject will be exposed and they will be complemented with some example. The exhibitions are, in some cases, a synthesis of everything that is a subject, which must be complemented from the recommended bibliography. Class time is limited and the extension of the explanations is adapted to its availability, without this being meant to reduce the contents of the syllabus. If, after the personal study, there are concepts that require more explanation, there is weekly tutoring for being able to attend them
Presentation of examples that illustrate its application. In order to clarify some of the concepts, examples of practical application will be presented that will be resolved in class or will have to be resolved at home and the result will be given.
In the cases indicated, you must make prior readings recommended before the classes where the subjects will be exposed

2) Classes "Problems"

Discussion and resolution of problems and applications related to the concepts of each topic
The problems proposed in the collection of problems are basically worked. In the Virtual Campus you can find a set of statements of application problems for each topic. This will be the problems that need to be worked and they are intended to be resolved before the class session. During the classes the difficulties will be solved and the different resolution modes that may be proposed will be discussed.
The statements of the Virtual Campus constitute a minimum collection of statements that all will solve. In no case,

they are the only ones that need to be worked, but others must be found in the recommended bibliography. If problems with non-collection problems occur, they will be first attended in tutoring.

3) Laboratory practices

In the weeks indicated in the calendar, there will be two practices in the laboratory on experiments that allow to verify any of the laws seen during the course.

These two practice sessions will take place in the physics laboratory, located in room -1.02 of the Higher Polytechnic School.
In order to have a practice grade, **it is mandatory** to attend these two laboratory sessions to carry out the practices and submit the corresponding reports within the specified period
In the Virtual Campus you will find the scripts for each one of the practices. These scripts are compulsory reading and study before coming to the laboratory session.
For each practice, a report of the work done must be submitted, which will be the basis for its evaluation

Development plan

WEEK	Subject-Activities
1	Introduction Unit 1 Unit 2
2	Unit 2 Unit 3
3	Unit 4
4	Unit 4
5	Unit 4 Unit 5
6	Unit 5
7	Unit 6
8	Unit 6
9	Evaluation: Exam 1st PARTIAL
10	1st Exam resolution (optional activity) Unit 6 Laboratory sesion 1
11	Unit 7 Laboratory session 2
12	Unit 7
13	Unit 7 Unit 8
14	Unit 8 Unit 9
15	Unit 9
16	Evaluation: Exam 2nd PARTIAL
17	
18	
19	Evaluation: Recovery Final Exam

Evaluation

Evaluation system

I. ACTIVITIES THAT CONSTITUTE THE CONTINUOUS EVALUATION THROUGHOUT THE SEMESTER:

COMPULSORY EVALUATION ACTIVITIES

These are compulsory activities to be able to pass the subject through the process of continuous assessment. When the student has not done any of the 3 compulsory activities (PA1, PA2, PA3) he / she will obtain a maximum final mark of 3.5 points, regardless of whether the application of the percentages can give another superior result. Therefore, you will need to apply for Recovery.

PA1: 1st Partial Exam, Week 9

Content: all the syllabus that has been developed until week 8 included (indicative: topics 1,2,3,4,5).

Percentage: **29,5 %**

PA2: 2nd Partial Exam, Week 16-17

Content: all the topics included in the "Contents" section of the teaching guide for this subject

Percentage: **50 %**

PA3: Laboratory Practices

In order to obtain an assessment of the laboratory practices activity and to have the PA3 qualification, the following two requirements must be met:

a) **Compulsory attendance** to 2 laboratory sessions (schedule scheduled in weeks 10 and 11)

Warning: in the case of laboratory practices, there is NO possibility of recovering them outside the established practice periods. Any incident that affects attendance at the scheduled session and has not been promptly reported to the laboratory practices teacher will NOT be addressed.

b) Presentation of a **laboratory practices report** (date to be set, week 14)

Percentage: **10,5 %**

OPTIONAL EVALUATION ACTIVITIES (NON-COMPULSORY)

The following activities are not mandatory in order to be eligible for continuous assessment throughout the semester.

PA4: Follow-up activities and classroom practices.

The activities that are part of this evaluation block are of two types. On the one hand, short tests on the topics presented in the theory sessions will be proposed throughout the course and through the Virtual Campus, which must be resolved within the period indicated when it is published. The objectives of this activity are to maintain a constant work rhythm, assess the degree of achievement of the group's learning outcomes and detect the concepts that require more attention in class. The content of each test will be seen in the previous class session and the questions will be mostly conceptual.

Percentage: **5 %**

In addition, classroom practice sessions will propose activities that will be part of the assessment process. These activities can be problem deliveries, classroom problem solving, or the like. Each classroom practice teacher will specify the activities throughout the course.

Percentage: **5 %**

CALCULATION OF THE FINAL GRADE FOR CONTINUOUS EVALUATION

If the assessment activities PA1, PA2 and PA3 have been carried out, the final grade of the subject will be calculated from the activities PA1, PA2, PA3 and PA4 in the following way:

N1 = PA1 * 0.295 + PA2 * 0.5 + PA3 * 0.105 * + PA4 * 0.1

II. RECOVERY

If you do not pass the continuous assessment throughout the semester, you can opt for recovery. In this case, you must take a resit exam.

PA5 Recovery Exam, Week 19

Content: all the topics included in the "Contents" section of the teaching guide for this subject.

Percentage: **80 %**

CALCULATION OF THE FINAL GRADE FOR RECOVERY

ALL people who take the PA5 recovery exam will have a final grade that will be given by:

N2 = PA5 * 0.8 + PA3 * 0.10 + PA4 * 0.10

IMPORTANT REMARKS

- People who have a minimum N1 continuous assessment mark of 4 but do not reach 5, can choose to take the recovery or keep the N1 mark, which would go to the final report. In case they choose to present themselves to the recovery, the final mark will be IN ALL CASES the mark N2, that results from the examination of recovery, PA5, and of the proofs PA3 and PA4, in the form that has been indicated.

III. Laboratory Practices validation

- Students who have passed the laboratory practices last academic course 22-23 can validate the laboratory practices and keep the grade for this academic course. In this case it will be necessary to request the validation in the form and term indicated in the beginning of the course.

- laboratory practices approved in courses prior to 22-23 are not validated in any case and must be repeated.

IV. ALTERNATIVE ASSESSMENT

Students who have the approval to be assessed through alternative assessment (see requirements and procedure in the assessment regulations) must carry out the following activities.

PA6: Final Exam Week 16-17

Content: all topics included in the "Contents" section of the teaching guide for this subject

Percentage: **90%**

PA3: Practices

In order to get an assessment of the internship activity and have the PA3 qualification, the following two requirements must be met:

a) Compulsory attendance at 2 laboratory sessions (scheduled schedule in weeks 10 and 11)
Warning: as these are laboratory practices, there is NO possibility of recovering them outside the established practice periods. Any incident that affects attendance at the scheduled session and has not been promptly communicated to the practice teacher will NOT be attended to.

b) Presentation of an internship report (date to be set, week 14)

Percentage: **10%**

CALCULATION OF THE FINAL GRADE FOR ALTERNATIVE ASSESSMENT

If the indicated assessment activities have been carried out, the final grade for the subject will be calculated as follows:

N1=PA6*0.90+P3*0.10

V. RECOVERY ALTERNATIVE ASSESSMENT

If you do not pass the subject, you will have the possibility to recover it in the following way:

PA5 Recovery exam, Week 19

Content: all topics included in the "Contents" section of the teaching guide for this subject.

Percentage: **90%**

CALCULATION OF THE FINAL GRADE FOR RECOVERY IN ALTERNATIVE ASSESSMENT

N2 = PA5*0.9+PA3*0.1

Bibliography

Fundamental Bibliography:

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R.A.Serway - J.W.Jewett. *Física para ciencias e ingenierías*, Vol. 1, 6ª edición. Ed. Thomson. México D.F. 2005. ISBN 970-686-423-7

R. Magro, L. Abad, M. Serrano, A.I. Velasco, S. Sánchez, J. Tejedor. Fundamentos de Física I. García-Maroto Editores. Madrid 2010. ISBN 978-84-937509-7-8. (Disponible en edició digital a www.ingebook.com)

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Complementary Bibliography:

S.Burbano de Ercilla, et.al. *Física General,* 32ª edición.Editorial Tébar, Zaragoza 2003. ISBN 84-95447-82-7

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F.J.Bueche. *Física General*. 9ª edición. McGraw-Hill, MéxicoD.F. 2000.Biblografia Complementària:

James KAKALIOS, *La Física de los Superhéroes*, Ediciones Robinbook,Barcelona 2006. ISBN 84-96222-72-1

on-line resources:

Ángel Franco García, Curso Interactivo de Física.

Walter Lewin, Classical Mechanics. 8.01x - MIT Physics I: Classical Mechanics. Videos del curs.

Scientific lectures:

José Muñoz Santonja. *Newton. El umbral de la ciencia moderna*. Editorial Nívola. ISBN 978-84-92493-55-5

Isaac Newton y Eloy Rada García (Traductor). *Principios Matemáticos de Filosofía Natural*, Vol.1. Alianza Editorial.

Madrid 1998. ISBN978-84-206-2918-6

Manuel Valera. *Hooke. La ambición de una ciencia sin límites*. Editorial Nívola. ISBN 978-84-95599-86-5

Jorge Wagensberg. *Yo, lo superfluo y el error*. TusquetsEditores. Colección Metatemas nº107. Barcelona 2009. ISBN 978-84-8383-154-0

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