



## 1. General information

Course: FUNDAMENTALS OF PHYSICS I

Type: BASIC

Degree: 422 - UNDERGRADUATE DEGREE IN BIOMEDICAL ENGINEERING

Center: 308 - SCHOOL POLYTECHNIC OF CUENCA

Year: 1

Main language: Spanish

Use of additional languages:

Web site:

Code: 59703

ECTS credits: 6

Academic year: 2023-24

Group(s): 30

Duration: First semester

Second language:

English Friendly: Y

Bilingual: N

|   |  |              |                          |   |
|---|--|--------------|--------------------------|---|
| Lecturer: JOAN MIQUEL GALVE ROMERO - Group(s): 30 |  |              |                          |   |
| Building/Office                                   | Department   | Phone number | Email                    | Office hours  |
| Escuela Politécnica de Cuenca/IDR                 | FISICA APLICADA  | +34926053217 | joanmiquel.galve@uclm.es | The updated tutorial schedule can be consulted in the virtual secretary |
| Lecturer: RAQUEL RAMÍREZ VÁZQUEZ - Group(s): 30   |  |              |                          |   |
| Building/Office                                   | Department   | Phone number | Email                    | Office hours  |
|   | FISICA APLICADA  |              | Raquel.Ramirez@uclm.es   |   |
| Lecturer: SERGIO RUBIO LUQUE - Group(s): 30       |  |              |                          |   |
| Building/Office                                   | Department   | Phone number | Email                    | Office hours  |
|   | INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES |              | Sergio.Rubio@uclm.es     |   |

## 2. Pre-Requisites

Since this is a subject that begins in the first semester, it is not necessary to have specific knowledge of any other subject, although it is necessary the basic knowledge of secondary education, especially in physics and mathem

## 3. Justification in the curriculum, relation to other subjects and to the profession

The subject of physics of the Degree in Biomedicine Engineering is divided into two subjects belonging to the block of basic subjects of the degree. Fundamentals of Physics I describes the physical laws and scientific bases of t

## 4. Degree competences achieved in this course

| Course competences |             |
|--------------------|-------------|
| Code               | Description |
| INFO-2023          |             |

## 5. Objectives or Learning Outcomes

| Course learning outcomes  |
|---|
| Description   |
| CT01 - To know and apply Information and Communication Technologies.  |
| CT02 - To use properly oral and written communication.  |
| CT03 - To know ethical commitment and professional deontology.  |
| CN02 - To understand and master basic concepts of the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism, as well as apply them to solve engineering problems. |

## 6. Units / Contents

|  |
|--|
| <b>Unit 1: Physical magnitudes</b>   |
| Unit 1.1 Dimensional analysis  |
| Unit 1.2 Errors treatment  |
| Unit 1.3 Review operations with vectors  |
| Unit 1.4 PRACTICE 1. The measurement and its treatment                                     |
| <b>Unit 2: Kinematics</b>  |
| Unit 2.1 Rectilinear motion  |
| Unit 2.2 Circular motion   |
| Unit 2.3 Simple harmonic motion  |
| Unit 2.4 Motion composition  |
| Unit 2.5 PRACTICAL EXERCISE. Study of 2D motion using Excel                                |
| Unit 2.6 PRACTICAL EXERCISE. Calculation of speeds and numerical accelerations using Excel |
| <b>Unit 3: Dynamics</b>  |
| Unit 3.1 Forces. Newton's Laws   |
| Unit 3.2 Work and energy   |
| Unit 3.3 Power   |
| <b>Unit 4: Mechanical oscillators</b>  |
| Unit 4.1 Damped oscillators  |
| Unit 4.2 Forced oscillators  |
| Unit 4.3 Electrical analogy. RCL circuit   |
| Unit 4.4 PRACTICE 2. Study of the elastic constant of a spring                             |
| <b>Unit 5: One-dimensional waves. The vibrating rope</b>                                   |
| Unit 5.1 Mechanical waves on a forced rope at one end                                      |
| Unit 5.2 Reflection and transmission of waves on a vibrating string                        |
| Unit 5.3 Own modes on a finite length string   |
| Unit 5.4 PRACTICE 3. Stationary waves on a string  |
| <b>Unit 6: Two-dimensional waves. Vibrating membranes</b>                                  |
| Unit 6.1 Two-dimensional. Helmholtz Equation   |
| Unit 6.2 Own modes in 2D   |
| Unit 6.3 PRACTICAL EXERCISE. Own modes in a rectangular membrane with Matlab               |
| <b>Unit 7: Fundamentals of thermology</b>  |
| Unit 7.1 Thermal expansion   |
| Unit 7.2 Ideal gases   |
| Unit 7.3 Laws of thermodynamics  |
| Unit 7.4 Heat transfer   |
| <b>Unit 8: Three-dimensional waves. Acoustic waves</b>                                     |
| Unit 8.1 Acoustic wave equation in 3D. Flat waves and spherical waves                      |
| Unit 8.2 Intensity and intensity level   |
| Unit 8.3 Own modes in rooms  |
| Unit 8.4 Acoustic waveguides   |

## ADDITIONAL COMMENTS, REMARKS

The didactic material used in the development of the subject, and which is available in the virtual platform of the course, is:

- Software: Excel and Matlab
- Notes: transparencies of the subject.
- Collection of exercises
- Practices manual

## 7. Activities, Units/Modules and Methodology

| Training Activity                      | Methodology                   | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description  |
|--|-------------------------------|---|------|-------|----|-----|--|
| Class Attendance (theory) [ON-SITE]    | Lectures                      | INFO-2023   |      | 1     | 25 | N   | Theoretical classes of the subject in which the syllabus is developed                  |
| Class Attendance (practical) [ON-SITE] | Problem solving and exercises | INFO-2023   |      | 1     | 25 | N   | During the classes there will be demonstrations and exercises of those required points |

|   |                                  |           |                                      |     |   |   |  |
|---|----------------------------------|-----------|--------------------------------------|-----|---|---|--|
| Computer room practice [ON-SITE]          | Practical or hands-on activities | INFO-2023 | 0.12                                 | 3   | Y | Y | During the practical sessions, the realization of the practicals and the results obtained will be evaluated in-situ. In the case of not being able to attend the sessions for justified reasons, in the ordinary exam there will be a test that allows to pass this part.  |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | INFO-2023 | 0.12                                 | 3   | Y | Y | During the laboratory sessions, the performance of the practices and the results obtained will be evaluated in-situ. In the case of not being able to attend the sessions for justified reasons, in the ordinary call there will be a test that allows to pass this part.  |
| Writing of reports or projects [OFF-SITE] | Self-study                       | INFO-2023 | 1.6                                  | 40  | Y | Y | In general, for each of the practices a report will be delivered describing the work carried out, and showing the results and analysis, as well as the main conclusions. If plagiarism is detected in any of the deliveries, the grade will be 0 points in that activity, both for the person / group who has plagiarized and for the one who has allowed it (art. 9 REE). |
| Study and Exam Preparation [OFF-SITE]     | Self-study                       | INFO-2023 | 2                                    | 50  | N | - | Autonomous work of the student to prepare the subject  |
| Individual tutoring sessions [ON-SITE]    | Guided or supervised work        | INFO-2023 | 0.04                                 | 1   | N | - | Resolution of doubts and review of grades  |
| Mid-term test [ON-SITE]                   | Assessment tests                 | INFO-2023 | 0.04                                 | 1   | Y | Y | 1 or 2 written evaluation tests will be established throughout the semester. This activity will be recovered with a new test in ordinary or extraordinary exams. The fraudulent realization of the tests will suppose a grade of 0 points (art. 9 REE).  |
| Final test [ON-SITE]                      | Assessment tests                 | INFO-2023 | 0.08                                 | 2   | Y | Y | Corresponds to the test to be carried out on the date of the ordinary exam. This activity will be recovered with a new test on the date of the extraordinary exam. The fraudulent realization of the tests will suppose a grade of 0 points (art. 9 REE).  |
| Total:                                    |                                  |           | 6                                    | 150 |   |   |  |
| Total credits of in-class work: 2.4       |                                  |           | Total class time hours: 60           |     |   |   |  |
| Total credits of out of class work: 3.6   |                                  |           | Total hours of out of class work: 90 |     |   |   |  |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

| 8. Evaluation criteria and Grading System |                       |                            |   |
|---|-----------------------|----------------------------|---|
| Evaluation System                         | Continuous assessment | Non-continuous evaluation* | Description   |
| Test                                      | 80.00%                | 80.00%                     | Proof of progress will be weighted to obtain a numerical score between 0 and 10. This test can be divided into partial tests made throughout the course, where theoretical / practical knowledge will be evaluated. At least 10% of the progress tests must include the individualized grade of the work done in group by the students. This qualification will represent 80% of the total grade of the subject |
| Laboratory sessions                       | 20.00%                | 20.00%                     | The exercises and delivery questionnaires solved in the classroom and at home, together with the laboratory practices and their public exposure will mean a numerical grade from 0 to 10. This qualification will mean 20% of the total grade of the subject.<br>Students who can not attend laboratory practices should contact the responsible teacher at the beginning of the semester.                      |
| <b>Total:</b>                             | <b>100.00%</b>        | <b>100.00%</b>             |   |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

It is necessary to obtain a grade greater than or equal to 4 points in each of the written tests to be able to average with the rest of the evaluation activities. The average of all the evaluation activities must be equal to or greater than 5 points to pass the subject.

The final exam will be a global test that allows to overcome separately both the practices and the theoretical / practical contents developed throughout the course for those students who have not passed any of the partial evaluation tests.

##### Non-continuous evaluation:

The final exam will be a global test that allows to overcome separately both the practices and the theoretical / practical contents developed throughout the course for those students who have not passed any of the partial evaluation tests.

#### Specifications for the resit/retake exam:

The final exam will be a global test of the whole subject

| 9. Assignments, course calendar and important dates  |              |
|--|--------------|
| Not related to the syllabus/contents   |              |
| <b>Hours</b>   | <b>hours</b> |
| Computer room practice [PRESENCIAL][Practical or hands-on activities]  | 3            |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]   | 3            |
| Writing of reports or projects [AUTÓNOMA][Self-study]  | 40           |
| Study and Exam Preparation [AUTÓNOMA][Self-study]  | 50           |
| Individual tutoring sessions [PRESENCIAL][Guided or supervised work]   | 1            |
| Mid-term test [PRESENCIAL][Assessment tests]   | 1            |
| Final test [PRESENCIAL][Assessment tests]  | 2            |
| <b>General comments about the planning:</b> The units will be taught consecutively adapting to the actual calendar that is held in the semester in which the subject is located. Works will be asked with a periodicity of two weeks, corresponding to the taught agenda. It is also planned to conduct a progress test, not mandatory, mid-term equivalent to 40% of the final grade of the subject. Also depending on the progress of the subject, the planning will be adapted. |              |
| <b>Unit 1 (de 8): Physical magnitudes</b>  |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 1            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 1            |
| <b>Unit 2 (de 8): Kinematics</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 3            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 3            |
| <b>Unit 3 (de 8): Dynamics</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 3            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 4            |
| <b>Unit 4 (de 8): Mechanical oscillators</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 3            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 3            |
| <b>Unit 5 (de 8): One-dimensional waves. The vibrating rope</b>  |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 6            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 6            |
| <b>Unit 6 (de 8): Two-dimensional waves. Vibrating membranes</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 2            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 2            |
| <b>Unit 7 (de 8): Fundamentals of thermology</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 3            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 3            |
| <b>Unit 8 (de 8): Three-dimensional waves. Acoustic waves</b>  |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 4            |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 3            |
| <b>Global activity</b>   |              |
| <b>Activities</b>  | <b>hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 25           |
| Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]   | 25           |
| Computer room practice [PRESENCIAL][Practical or hands-on activities]  | 3            |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]   | 3            |
| Writing of reports or projects [AUTÓNOMA][Self-study]  | 40           |
| Study and Exam Preparation [AUTÓNOMA][Self-study]  | 50           |
| Individual tutoring sessions [PRESENCIAL][Guided or supervised work]   | 1            |
| Final test [PRESENCIAL][Assessment tests]  | 2            |
| Mid-term test [PRESENCIAL][Assessment tests]   | 1            |
| <b>Total horas: 150</b>  |              |

| 10. Bibliography and Sources            |   |                                     |      |                     |      |             |
|---|---|-------------------------------------|------|---------------------|------|-------------|
| Author(s)                               | Title/Link  | Publishing house                    | City | ISBN                | Year | Description |
| Kinsler                                 | Fundamentos de acústica                                     | Limusa / Noriega Editores           |      | 968-18-2026-6       | 1995 |             |
| Linares, Llopis, Sancho                 | Acústica arquitectónica                                     | Servicio de publicaciones de la UPV |      |                     |      |             |
| Serway, Raymond A.                      | Física para ciencias e ingeniería                           | McGraw-Hill                         |      | 970-10-3582-8 (tomo | 2002 |             |
| Tipler, Paul Allen                      | Física para la ciencia y la tecnología                      | Reverté                             |      | 978-84-291-4428-4   | 2014 |             |
| Young y Freedman                        | Física universitaria  | Pearson                             |      | 978-607-32-2124-5   | 2013 |             |
| Alonso M. y Finn E.J.                   | Física  | Adison Wesley                       |      |                     |      |             |
| González, Félix A. (González Hernández) | La física en problemas                                      | Tébar Flores                        |      | 84-95447-07-X       | 2000 |             |
| Arribas Garde, Enrique                  | Introducción a la física : (magnitudes, errores, vectores y | Moralea                             |      | 84-95887-02-9       | 2001 |             |