



## IDENTIFYING DATA

### Physics: Physics 2

|                     |                                                                                                                                                                                                                                               |                 |      |            |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|------------|
| Subject             | Physics: Physics 2                                                                                                                                                                                                                            |                 |      |            |
| Code                | 007G410V01202                                                                                                                                                                                                                                 |                 |      |            |
| Study programme     | (*)Grao en Enxeñaría Aeroespacial                                                                                                                                                                                                             |                 |      |            |
| Descriptors         | ECTS Credits                                                                                                                                                                                                                                  | Choose          | Year | Quadmester |
|                     | 6                                                                                                                                                                                                                                             | Basic education | 1st  | 2nd        |
| Teaching language   | Spanish                                                                                                                                                                                                                                       |                 |      |            |
| Department          |                                                                                                                                                                                                                                               |                 |      |            |
| Coordinator         | Michinel Álvarez, Humberto Javier                                                                                                                                                                                                             |                 |      |            |
| Lecturers           | Michinel Álvarez, Humberto Javier<br>Salgueiro Piñeiro, Jose Ramon<br>Tommasini, Daniele                                                                                                                                                      |                 |      |            |
| E-mail              | hmichinel@uvigo.es                                                                                                                                                                                                                            |                 |      |            |
| Web                 | <a href="http://optics.uvigo.es">http://optics.uvigo.es</a>                                                                                                                                                                                   |                 |      |            |
| General description | Physics II is a subject fundamentally devoted to endow to the student of the training and basic competitions in the areas of electromagnetism and introduction to the thermodynamics, covering the theoretical and practical aspects of both. |                 |      |            |

## Competencies

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Code |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |
| A1   | (*)Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo                                                                                                                                                                  |  |  |  |
| B2   | (*)Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo. |  |  |  |
| C2   | (*)Comprensión e dominio dos conceptos básicos sobre as leis xerais da mecánica, termodinámica, campos e ondas e electromagnetismo e a súa aplicación para a resolución de problemas propios da enxeñaría.                                                                                                                                                                                                                                                                                        |  |  |  |
| D1   | (*)Capacidade de análise, organización e planificación                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |
| D3   | (*)Capacidade de comunicación oral e escrita na lingua nativa                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |
| D4   | (*)Capacidade de aprendizaxe autónoma e xestión da información                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |
| D5   | (*)Capacidade de resolución de problemas e toma de decisións                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |
| D6   | (*)Capacidade de comunicación interpersoal                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| D8   | (*)Capacidade de razoamento crítico e autocrítico                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |

## Learning outcomes

| Expected results from this subject                                                                                                                                             | Training and Learning Results |    |    |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----|----|----------------------------------|
| Knowledge, understanding, of the basic principles of Physics and its application to the analysis and to the resolution of engineering problems.                                | A1                            | B2 | C2 | D1<br>D3<br>D4<br>D5<br>D6<br>D8 |
| Knowledge, understanding and application of the principles of the electromagnetism, including electrostatics, magnetostatics and Maxwell's equations.                          | A1                            |    | C2 | D5<br>D8                         |
| Knowledge, understanding and application of the general laws of the classical Thermodynamics, including the concept of thermodynamic balance and the thermodynamic magnitudes. |                               |    | C2 | D5<br>D8                         |

## Contents

**Topic**

|                                        |                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Introduction to Thermodynamics.        | Temperature and pressure.<br>Heat and Work.<br>Internal energy.<br>First Principle of the Thermodynamics.<br>Heat Capacity.<br>Perfect gas.<br>Reversible and irreversible processes.<br>Thermal machines.<br>Thermodynamic cycles.<br>Second Principle of the Thermodynamics.                                                         |
| Electrostatics.                        | Historical introduction.<br>Charge and charge density.<br>Conductive media.<br>Field, Potential and electrostatic energy.<br>Gauss' law.<br>Poisson and Laplace equations.<br>Multipolar expansion of fields.<br>Dielectrics, Displacement vector.<br>Boundary conditions of the fields.                                               |
| Electrical current and Magnetostatics. | Electrical current.<br>Circuits (DC)<br>Equation of continuity.<br>Lorentz's force.<br>Magnetic induction.<br>Circuits (AC).<br>Particle motion in electromagnetic fields.<br>Biot-Savart law.<br>Ampere law.<br>Magnetic dipoles, magnetic moment.<br>Macroscopic media, magnetic field vector.<br>Boundary conditions of the fields. |
| Introduction to the Electrodynamics.   | Faraday's law.<br>Electromagnetic energy.<br>Maxwell's displacement current.<br>Maxwell's equations.<br>Vector and scalar magnetic potential.<br>Electromagnetic waves.                                                                                                                                                                |

**Planning**

|                                    | Class hours | Hours outside the classroom | Total hours |
|------------------------------------|-------------|-----------------------------|-------------|
| Master Session                     | 19          | 28.5                        | 47.5        |
| Laboratory practises               | 12          | 15                          | 27          |
| Troubleshooting and / or exercises | 7           | 7                           | 14          |
| Introductory activities            | 1.5         | 0                           | 1.5         |
| Seminars                           | 20          | 30                          | 50          |
| Multiple choice tests              | 3           | 0                           | 3           |
| Long answer tests and development  | 4           | 0                           | 4           |
| Troubleshooting and / or exercises | 2           | 0                           | 2           |
| Reports / memories of practice     | 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                                                                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Master Session                     | Classes of an hour of length in which the professor exposes the main theoretical concepts of the subject.                                        |
| Laboratory practises               | Development of experiments in the laboratory, illustrating the main theoretical concepts developed previously in the master sessions.            |
| Troubleshooting and / or exercises | Resolution of practical exercises by the professor, similar to those to be solved by the student.                                                |
| Introductory activities            | Introduction of the subject and the teachers. Presentation of the laboratory.                                                                    |
| Seminars                           | Resolution of selected problems by part of the professor, in relation with the theoretical concepts developed previously in the master sessions. |

**Personalized attention**

| Methodologies                      | Description                                                                                                                   |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Laboratory practises               | The professor explains individually the development of the practices to do in the laboratory.                                 |
| Master Session                     | The professor supervises individually the correct assimilation of the theoretical concepts developed in the master sessions.  |
| Seminars                           | The professor supervises individually the correct resolution of the problems proposed in the classes of seminars.             |
| Introductory activities            | Presentation of the subject and the teacher. Presentation of the laboratory.                                                  |
| Troubleshooting and / or exercises | The professor solves exercises of a similar level of difficulty as those to be addressed by the student in an autonomous way. |

| Assessment                         |                                                                                                            |               |                               |    |                                  |
|------------------------------------|------------------------------------------------------------------------------------------------------------|---------------|-------------------------------|----|----------------------------------|
|                                    | Description                                                                                                | Qualification | Training and Learning Results |    |                                  |
| Multiple choice tests              | Examination type test of between 30 and 50 multioption questions.                                          | 20            | A1                            | B2 | C2                               |
| Long answer tests and development  | Examination of between 3 and 10 questions to be developed individually by the student.                     | 30            |                               | C2 | D1<br>D3<br>D8                   |
| Troubleshooting and / or exercises | Examination of problems with multiple sections to be solved individually by the student in a limited time. | 30            |                               | C2 | D1<br>D5                         |
| Reports / memories of practice     | Presentation and oral exhibition if it was necessary of the reports about the laboratory experiments.      | 20            |                               | C2 | D1<br>D3<br>D4<br>D5<br>D6<br>D8 |

#### Other comments on the Evaluation

#### Sources of information

Cheng, D.K., **Fundamentos de electromagnetismo para ingeniería**, Addison Wesley Iberoamericana,  
Feynman, R.P. Leighton R.B., **Lectures on Physics, Vol II**, Addison Wesley Publishing,  
Edminister, J.A., **Electromagnetismo**, McGraw-Hill,  
Jackson J.D., **Classical electrodynamics.**, Elsevier, Amsterdam,  
Serrano, V, **Electricidad y Magnetismo: Estrategias para la resolución de problemas y aplicaciones**, Prentice Hall,  
Alexeiev, A.I., **Problemas de electrodinámica clásica.**, MIR, Moscu,  
Edminister, J.A., **Circuitos Eléctricos**, McGraw-Hill,  
Feynman, R.P. Leighton R.B., Sands M., **Exercises for the Feynman Lectures on Physics**, Addison Wesley Publishing,  
Batygin, V.V., **Problems in lectrodynamics.**, Academic Press, Londres,  
Cheng, D.K., **Field and wave electromagnetics**, Addison Wesley Publishing,  
Kong J.A., **Electromagnetic Wave Theory.**, John Wiley and Sons,  
Varios, <http://wikipedia.org>,

#### Recommendations

##### Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 2/O07G410V01201

##### Subjects that it is recommended to have taken before

Physics: Physics 1/O07G410V01103

Mathematics: Calculus 1/O07G410V01101