# Course guide
# 280633 - 280633 - Physics

**Last modified:** 26/10/2023

**Unit in charge:** Barcelona School of Nautical Studies
**Teaching unit:** 748 - FIS - Department of Physics.

**Degree:** BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Compulsory subject).
BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2023 **ECTS Credits:** 9.0 **Languages:** Catalan, Spanish

## LECTURER

**Coordinating lecturer:** ANTONIO ISALGUE BUXEDA

**Others:**

Primer quadrimestre:
ANTONIO ISALGUE BUXEDA - GEST1, GEST2, GTM
SERGIO MASSIP ALVAREZ - GEST1, GEST2, GTM
LLUÍS YEDRA CARDONA - GEST1, GEST2, GTM

Segon quadrimestre:
ANTONIO ISALGUE BUXEDA - GESTN, GTM
SERGIO MASSIP ALVAREZ - GESTN, GTM
DIEGO ALEJANDRO OCHOA GUERRERO - GESTN, GTM
LLUÍS YEDRA CARDONA - GESTN, GTM

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
GTM.CE1. Understanding and mastering the basics of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to problem solving pro principles of engineering.
GESTN.CE2. Understanding and mastery of the basics of the general laws of mechanics, thermodynamics, and electromagnetism fields and waves and its application for solving problems of the technical field of naval engineering.

**Generical:**
GTM.CG8. IDENTIFY I resoldre Capacitat PER L'Ambit problemes IN MARINA DE L'ENGINYERIA.
Capacitat per the plantejament i resolució of problemes de l'l'àmbit enginyeria assumint marina iniciatives, prenent decisions i aplicant solucions creatives in the marc d'a systematic methodology.

## TEACHING METHODOLOGY

. Receive, understand, and synthesize knowledge. (documentation in the library and at Atenea, videos, questionnaires, questions in the forum, web pages, homework assignments ...)
.Set up and solve problems and questions related to the subject. (questionnaires, and homework assignments)
.Develop rational thinking and criticism, and expose and support the reasonings (orally or in written form) (questionnaires, and homework assignments)
.Perform individual work. (homework assignments)
.Perform tasks in a reduced team. (homework assignments)
These can be done in person, or with documental, CIT, digital campus, chat, video, and videoconference support.

## LEARNING OBJECTIVES OF THE SUBJECT

· Understand and master the basics of the general laws of mechanics, thermodynamics, and wave fields, and electromagnetism.
· Apply basic physical principles to solving problems of engineering.
· Set up the problems correctly from the proposed statements and identify options for resolution. Apply the appropriate method of resolution.
· Perform the tasks on schedule, according to the guidelines set by the teacher or tutor. Identify progress and the degree to which learning objectives.

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Hours small group | 9,0 | 4.00 |
| Hours medium group | 36,0 | 16.00 |
| Guided activities | 9,0 | 4.00 |
| Self study | 126,0 | 56.00 |
| Hours large group | 45,0 | 20.00 |

**Total learning time:** 225 h

## CONTENTS

### 1. Mechanics

**Description:**
Description of the movement: Cinematics. Relative movement. Coriolis and centripetal accelerations. Changes in the movement: Dynamics. Newton's laws. Statics of rigid bodies. Rotation of a solid. Introduction to the gyroscope.
Introduction to the mechanics of materials. Stresses in solids and in fluids. Statics of fluids, Buoyancy. Fluids in movement: Equation of continuity and Bernoulli's equation. Movement with friction and with drag. Force, velocity and power. Energy in the transport.

**Specific objectives:**
Understand and master the basic concepts about the general laws of mechanics.
Apply the basic physical principles of mechanics to the resolution of simple problems.
Propose correctly the simple mechanical problems from the proposed statements and identify the options for their resolution

**Related activities:**
Reading of chapters of books specified in the bibliography, or notes, or by means of video.
Listen to the teacher and participate in the problem-solving, in person, in video or on-line.
Solve problems individually.
Realization of three practices with simulators (computer), on relative movement, movement with friction, and stopping of boats, and deliver the reports

**Full-or-part-time:** 51h
Theory classes: 12h
Practical classes: 12h
Laboratory classes: 2h
Guided activities: 1h
Self study : 24h

## 2. Oscillations

**Description:**
Periodic motion. Simple harmonic motion. The energy in the periodic motion. Damped Simple harmonic motion. Relaxation time and quality factor. Forced Simple harmonic motion. Resonance and bandwidth.

**Specific objectives:**
Understand and master the basic concepts about the general laws of vibrations.
Propose correctly the simple problems of oscillations from the proposed statements.

**Related activities:**
Read the book chapters related to the oscillations of some of the recommended bibliography books, or notes o recommended videos.
Listen to the teacher the indications on the ways to solve the simple exercises, in person or on video, or on-line.
Perform simple exercises on oscillations, autonomously
Perform a practice with pendulums, to evaluate the value of gravity and estimate the error, and deliver the report.

**Full-or-part-time:** 32h
Theory classes: 8h
Practical classes: 6h
Laboratory classes: 2h
Self study : 16h

## 3. Waves

**Description:**
Wave propagation. Wave equation. Mechanical waves. Examples: Waves on a rope, other examples. Harmonic waves. Superposition effect. Standing waves. Interference and diffraction. Energy and waves: Energy density and intensity. Acoustic waves. Sound pressure level. Doppler effect.

**Specific objectives:**
Understand and master the basic concepts about the general laws of the waves.
Propose correctly the wave problems from the proposed basic statements

**Related activities:**
Read the chapters corresponding to waves in one of the books of the recommended basic bibliography, or in notes or on recommended videos.
Listen to the teacher's instructions on solving problems, directly, on video or on-line.
Perform three practices with a computer simulator on aspects of waves, and deliver the reports..

**Full-or-part-time:** 50h
Theory classes: 10h
Practical classes: 10h
Laboratory classes: 6h
Self study : 24h

### 4. Thermodynamics and thermal properties of matter

**Description:**
Heat, work, and temperature. Thermodynamic systems. States of matter. Psychrometric diagram. Stability of the atmosphere. Introduction to heat transfer. Newton's law for the cooling of a body. Conduction, Convection, and Radiation (part of STCW AIII-2_II: Theoretical knowledge: Thermodynamics and heat transmission). Thermodynamics Principles: Zero and First principles. Adiabatic processes. Second Principle: Thermal engines and cycles. Entropy. Thermodynamic Potentials. Enthalpy

**Specific objectives:**
Understand and master the basic concepts about the general laws of Thermodynamics.
Propose correctly the simple problems of thermodynamics from the basic statements proposed.

**Related activities:**
Read the corresponding chapters in one of the books of the recommended basic bibliography, or on notes or on recommended videos.
Listen to the teacher's instructions on solving problems, directly, on video or on-line.
Perform an experimental practice (the cooling of a body) with a digital thermometer, write the report and deliver it.

**Full-or-part-time:** 40h
Theory classes: 10h
Practical classes: 8h
Laboratory classes: 2h
Self study : 20h

### 5. Electricity and magnetism

**Description:**
Concepts of charge and electric field. Electric current. Basic laws of the electric and magnetic fields. Quasistatic magnetic field; sources and effects. Effect of the magnetic field on a magnetic moment. Electric and magnetic fields and materials. Electromagnetic induction. Generators.

**Specific objectives:**
Understand and master the basic concepts about the general laws of electromagnetism.
Propose correctly the simple problems on the magnetic field from the proposed basic statements.

**Related activities:**
Read the corresponding chapters in one of the books of the recommended basic bibliography, or on notes, or on recommended videos.
Listen to the teacher's instructions on solving problems, directly or on video or on-line.
Perform an experimental practice (magnetic field of a magnet and its interaction with a compass), write the report, and deliver it.

**Full-or-part-time:** 32h
Theory classes: 8h
Practical classes: 6h
Laboratory classes: 2h
Self study : 16h

**6. Electromagnetic waves, light and properties**

**Description:**
Description of electromagnetic waves. Electromagnetic radiation and light. Measurement and properties of light. Light rays and optics. Thermal radiation, quantization and related phenomena.

**Specific objectives:**
Understand and master the basic concepts about the general laws of electromagnetic waves.

**Related activities:**
Read the chapters corresponding to electromagnetic waves in some of the books of the recommended basic bibliography, or on notes or on recommended videos.
Solve some problems and questions on the subject

**Full-or-part-time:** 20h
Theory classes: 6h
Practical classes: 4h
Self study : 10h

## GRADING SYSTEM

It is mandatory to perform the laboratory sessions and submit the laboratory report. To obtain a numerical final grade (N_FinalAsignatura), different from NP (not presented), the student must sign and submit the academic integrity commitment and have completed and delivered at least 80% of the evaluable activities (Labs + Continuous Assessment).

The final grade is the sum of the following partial grades:

N_FinalAsignatura = 0.30 N_FinalEx + 0.25 N_ Labs + 0.45 N_Continuous Assessment

N_FinalAsignatura: final grade (must be > = 5.0 to pass the course).

Students with grades between 3.0 and 4.9 can take a re-evaluation exam according to the conditions determined by the University and the Faculty, on the dates determined by the center. For the re-evaluation exam, the grades of laboratory sessions and other delivered activities obtained during the course (N_ Labs) could be improved before taken the re-evaluation exam. The final grade for students taking the re-evaluation is:

N_FinalAsignatura = 0.75 * N_ reevaluation + 0.25 * N_ Labs

N_FinalAsignatura: a final grade of the subject.
N_FinalEx: grade of final tests (tests and deliveries) (after the class period).
N_ Labs: the laboratory sessions grade.
N_Continuous Assessment: grading of the partial exams, tests, and deliveries (during the class period).
N_ reevaluation: the note of the reevaluation exercises

The final test (and the reevaluation) will consist of questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and the delivery of a set of application exercises, done in a given time.
The Continuous Assessment consists of application exercises and questions, to be solved, sent, and delivered, leaving reliable evidence of completion by the student in the indicated time, in the virtual campus, or personally if possible.

Submissions and delivery of works will be done preferably through the digital campus. The laboratory sessions can be done either on a laboratory and computer room, or with simulators on the student's PC (connected to the internet), and where appropriate, with simple instruments that the students can have.

If any of the laboratory reports or continuous assessment are not delivered, it will be scored as zero.

The student must pass the laboratory (N_ Labs > = 5.0) to pass the course.

## EXAMINATION RULES.

. Activities not performed by the student will not receive a grade
. A student will receive a grade of "Not presented" if the student does not perform tasks that add 20% or more of the total grade

## BIBLIOGRAPHY


**Basic:**

- Valiente Cancho, Andrés. Física aplicada : 192 problemas útiles [on line]. 2a ed. Madrid: García Maroto Editores, 2013 [Consultation: 28/07/2023]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3948. ISBN 9788415793182.
- Valiente Cancho, Andrés. Fundamentos de física I : dinámica, fluidos y termodinámica : problemas resueltos [on line]. Madrid: García Maroto Editores, 2017 [Consultation: 28/07/2023]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6939. ISBN 9788416806225.
- Tipler, Paul A.; Mosca, Gene. Física para la ciencia y la tecnología. Vol. 1 Mecánica/Oscilaciones y Ondas/Termodinámica [on line]. 6a ed. Barcelona: Reverté, 2010 [Consultation: 24/01/2020]. Available on: https://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=10372. ISBN 9788429144284.
- Burbano, S.; Burbano, E.; Gracia, C. Física general. 32a ed. Madrid: Tebar, 2003. ISBN 8495447827.
- Gettys, W. Edward; Keller, Frederick J.; Skove, Malcolm J. Física para ingeniería y ciencias. 2a ed. México: McGraw-Hill, 2005. ISBN 9789701048894.
- Alonso, Marcelo; Finn, Edward J. Física. México: Addison-Wesley Longmann, 2000. ISBN 9684444265.
- Giancoli, Douglas C. Física: principios con aplicaciones, Vol. 1 [on line]. 6a ed. México: Pearson Educación, 2009 [Consultation: 02/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1283. ISBN 9786074429831.
- Giancoli, Douglas C. Física: principios con aplicaciones, Vol. 2 [on line]. 6a ed. México: Pearson Educación, 2009 [Consultation: 02/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1284. ISBN 9786074429824.

**Complementary:**

- Wilson, Jerry D.; Buffa Anthony J.; Lou, Bo. Física. 5a ed. México: Pearson educación, 2003. ISBN 9702604257.
- Blatt Frank J. Fundamentos de física. 3a ed. México: Prentice-Hall Hispanoamericana, 1991. ISBN 9688801933.
- Garcia-Morato, A. Física : leyes, fórmulas y ecuaciones [on line]. Madrid: L'autor, 2006 [Consultation: 01/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=32. ISBN 8493478504.
- Garcia-Maroto A. Física : 200 problemas útiles [on line]. Madrid: L'autor, 2006 [Consultation: 01/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=35. ISBN 8493478512.
- Cutnell, John D.; Johnson, Kenneth W. Física. 2a ed. México: Limusa Wiley, 2004. ISBN 9681864514.
- Young, Hugh D.; Freedman, Roger A.; Ford, A. Lewis. Física universitaria : Sears-Zemansky. Vol. 1 [on line]. 13a ed. México: Pearson Educación, 2013 [Consultation: 23/10/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4618. ISBN 9786073221252.
- González, Félix A. La física en problemas. Madrid: Tebar Flores, 1995. ISBN 8473601416.
- Bueche, F. Física general. 10a ed. Mexico: McGraw-Hill, 2007. ISBN 9789701061619.
- Tippens, Paul E. Física: conceptos y aplicaciones. 7a ed. Mexico: McGraw- hill, 2007. ISBN 9701062604.
- Pérez García, Víctor M.; Vázquez Martínez, Luis; Fernández-Rañada, Antonio. 100 Problemas de mecánica. Madrid: Alianza, 1997. ISBN 8420686360.
- Dias de Deus, J [et al.]. Introducción a la física. 2a ed. Madrid: McGraw-Hill, 2001. ISBN 8448131908.
- Resnick, Resnick; Halliday, David; Krane, Kenneth S. Física. 4a ed. México: CECSA, 2002. ISBN 9702402573.
- Martínez Sancho, Vicent. Fonaments de física. 2a ed. Barcelona: Enciclopèdia Catalana, 1991. ISBN 8477390010.
- Schaum, Daniel. Teoría y problemas de física general. Mexico: McGraw-Hill, 1970. ISBN 9684512074.
- Cromer, Alan H. Física en la ciencia y en la industria. Barcelona: Reverté, 1986. ISBN 8429141561.
- Casas Peláez, J. Óptica. 7a ed. Zaragoza: El autor, 1994. ISBN 8460500624.

## RESOURCES

**Hyperlink:**
- http://baldufa.upc.edu