

[GFC005] Quantum Physics I

GENERAL INFORMATION

Studies	ENGINEERING PHYSICS APPLIED TO INDUSTRY	Subject	Physics
Semester	2	Course	2
Character	COMPULSORY	Mention / Field of specialisation	
Plan	2022	Modality	Face-to-face
Credits	4,5	Language	CASTELLANO/EUSKARA
		Total hours	67.5 class hours + 45 non-class hours = 112.5 total hours

PROFESSORS

ASEGUINOLAZA AGUIRRECHE, UNAI
TELLERIA ALLIKA, XABIER

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
CALCULUS I	(No previous knowledge required)
LINEAR ALGEBRA	
CALCULUS II	
MATHEMATICAL METHODS APPLIED TO PHYSICS	
GENERAL PHYSICS I	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GFR108 - Understanding the principles of quantum physics and solving simple problems in one and three dimensions	x			4,06
G-RTR1 - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,24
G-RTR2 - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,2
Total:				4,5

KC: Knowledge or Content / SK: Skills / AB: Abilities

SECONDARY LEARNING RESULTS

RGF290 [!] *Muestra las habilidades para trabajar en grupo y resuelve los problemas planteados utilizando las herramientas adecuadas en cada caso.*

LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	1 h.	2 h.	3 h.

EVALUATION SYSTEM

	W
Self-assessment	25%
Co-assessment	25%
Observation (technical capacity, attitude and participation)	50%

MAKE-UP MECHANISMS

(No mechanisms)

CH - Class hours: 1 h.

NCH - Non-class hours: 2 h.

TH - Total hours: 3 h.

RGF291 [!] *Utiliza la metodología adecuada para encontrar las soluciones a los problemas y para desarrollar los proyectos: Examina bien los problemas, y busca información significativa para hacerle frente y propone las soluciones.*

LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in	2 h.	1 h.	3 h.

interdisciplinary contexts, real and/or simulated, individually and/or in teams

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

100%

(No mechanisms)

CH - Class hours: 2 h.

NCH - Non-class hours: 1 h.

TH - Total hours: 3 h.

RGF292 [!] *Comunica, busca y estructura correctamente la información de manera escrita: Redacta una memoria de proyecto clara y concisa siguiendo los criterios establecidos en la guía para la redacción de la memoria de proyectos y utilizando herramienta informá*

LEARNING ACTIVITIES

CH

NCH

TH

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

1 h.

2 h.

3 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

100%

(No mechanisms)

CH - Class hours: 1 h.

NCH - Non-class hours: 2 h.

TH - Total hours: 3 h.

RGF293 [!] *Comunica, busca y estructura correctamente la información de manera oral: Realiza una presentación oral y defensa del proyecto clara y concisa, utilizando adecuadamente los aspectos recogidos en la guía de comunicación oral y las herramientas informá*

LEARNING ACTIVITIES

CH

NCH

TH

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

1,5 h.

,5 h.

2 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

100%

(No mechanisms)

CH - Class hours: 1,5 h.

NCH - Non-class hours: ,5 h.

TH - Total hours: 2 h.

RGF219 [!] *Entiende las limitaciones de la mecánica clásica para explicar la física del mundo microscópico.*

LEARNING ACTIVITIES

CH

NCH

TH

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

6 h.

4 h.

10 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects

13 h.

8 h.

21 h.

Carrying out exercises and solving problems individually and/or in teams	9 h.	5,5 h.	14,5 h.
Practical work in workshops and/or laboratories, individually and/or in teams	3 h.	2 h.	5 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

10%

Individual written and/or oral tests or individual coding/programming tests

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

20%

Individual written and/or oral tests or individual coding/programming tests

70%

CH - Class hours: 31 h.

NCH - Non-class hours: 19,5 h.

TH - Total hours: 50,5 h.

RGF220 [!] *Resuelve la ecuación de Schrödinger de manera analítica para modelos sencillos de una y tres dimensiones*

LEARNING ACTIVITIES

CH

NCH

TH

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

6 h.

4 h.

10 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects

19 h.

13 h.

32 h.

Carrying out exercises and solving problems individually and/or in teams

3 h.

1 h.

4 h.

Practical work in workshops and/or laboratories, individually and/or in teams

3 h.

2 h.

5 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

10%

Individual written and/or oral tests or individual coding/programming tests

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

20%

Individual written and/or oral tests or individual coding/programming tests

70%

CH - Class hours: 31 h.

NCH - Non-class hours: 20 h.

TH - Total hours: 51 h.

CONTENTS

- Need for a quantum theory
 - Black body radiation, photoelectric effect, atomic spectra, Bohr model, and double slit experiment
- Introduction to the quantum theory
 - De Broglie postulate
 - Wave function and the statistical interpretation
 - The Schrödinger equation, superposition principle and the free particle
 - Operators, observables and Heisenberg's uncertainty principle
 - Permanent and non-permanent states
 - Measurement results and their probabilities
- Formalism of the quantum theory
 - Postulates of quantum mechanics
 - Commutators, compatible observables, and full group of commutable observables
 - Uncertainty principle
 - Time evolution of observables. Ehrenfest and Virial's theorems
 - Time independent Schrödinger equation
- One dimensional potentials
 - Infinite potential well, potential jump, potential wall, finite potential well, Dirac's delta potential and harmonic oscillator
- Three dimensional potentials

-
1. Free particle, square potential well, harmonic oscillator and hydrogen atom
6. Numerical solution of the Schrödinger equation

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
Moodle Platform
Class presentations
Slides of the subject
Labs

Bibliography

<https://labur.eus/UvEY5>