Approval date: 22/06/2023

COURSE GUIDE

Mechanics (2701129)

Grado (Bachelor's Degree)	Grado en Matemáticas	Branch	Sciences

Module	Formación Básica	Subject	Física

Year of study	2º	Semester	2º	ECTS Credits	6	Course type	Core course

PREREQUISITES AND RECOMMENDATIONS

It is recommended to have taken the course "General Physics".

BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)

- Fundamentals of Classical Mechanics.
- Oscillations.
- Waves.
- Field Theory (gravitational and electromagnetic).

SKILLS

GENERAL SKILLS

- CG01 - Poseer los conocimientos básicos y matemáticos de las distintas materias que, partiendo de la base de la educación secundaria general, y apoyándose en libros de texto avanzados, se desarrollan en esta propuesta de título de Grado en Matemáticas
- CG02 - Saber aplicar esos conocimientos básicos y matemáticos a su trabajo o vocación de una forma profesional y poseer las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de las Matemáticas y de los ámbitos en que se aplican directamente
- CG03 - Saber reunir e interpretar datos relevantes (normalmente de carácter matemático) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
- CG04 - Poder transmitir información, ideas, problemas y sus soluciones, de forma escrita u oral, a un público tanto especializado como no especializado
- CG06 - Utilizar herramientas de búsqueda de recursos bibliográficos

SUBJECT-SPECIFIC SKILLS

- CE03 - Asimilar la definición de un nuevo objeto matemático, en términos de otros ya conocidos, y ser capaz de utilizar este objeto en diferentes contextos
- CE04 - Saber abstraer las propiedades estructurales (de objetos matemáticos, de la realidad observada, y de otros ámbitos) y distinguirlas de aquellas puramente accidentales, y poder comprobarlas con demostraciones o refutarlas con contraejemplos, así como identificar errores en razonamientos incorrectos
- CE06 - Proponer, analizar, validar e interpretar modelos de situaciones reales sencillas, utilizando las herramientas matemáticas más adecuadas a los fines que se persigan
- CE07 - Utilizar aplicaciones informáticas de análisis estadístico, cálculo numérico y simbólico, visualización gráfica, optimización u otras para experimentar en matemáticas y resolver problemas

TRANSFERABLE SKILLS

- CT01 - Desarrollar cierta habilidad inicial de "emprendimiento" que facilite a los titulados, en el futuro, el autoempleo mediante la creación de empresas
- CT02 - Fomentar y garantizar el respeto a los Derechos Humanos y a los principios de accesibilidad universal, igualdad ante la ley, no discriminación y a los valores democráticos y de la cultura de la paz

LEARNING OUTCOMES

- To understand the nature of physical phenomena, with especial attention to their mathematical modelling.
- To become familiar with the basic conceptual frameworks in physics.
- To understand the work methods in physics, identifying the essence of the physical phenomena and their mathematical formulation.
- To acquire skills in modelling and solving problems in Mechanics with the appropriate Mathematical tools.

PLANNED LEARNING ACTIVITIES

THEORY SYLLABUS

- Lagrangian mechanics:

1. Constraints and generalised coordinates.
2. Principle of virtual work and Lagrange equations.
3. The principle of least action.
4. Interpretation and properties of the Lagrangian: conserved quantities.

- Central potentials:

1. Reduction of the two-body problem to an equivalent one-body problem.
2. Lagrangian and equations of motion.
3. Qualitative study of the trajectories.
4. The Kepler problem.

- Small oscillations:

1. Coupled oscillators. Normal modes.
2. Forced oscillations. Resonances.
3. Damped oscillations.

- Hamiltonian mechanics:

1. Hamiltonian formalism.
2. The Hamiltonian as a Legrendre transform.
3. Interpretation and conserved quantities.
4. Poisson brackets.
5. Canonical transformations.

PRACTICAL SYLLABUS

- Workshops to solve theory exercises and problems about each of the topics.

RECOMMENDED READING

ESSENTIAL READING

- L. N. Hand y J. D. Finch, Analytical mechanics, Cambridge University Press, 1998.
- V. I. Arnold, Mathematica methods of Classical Mechanics, Springer-Verlag, 1989.
- H. Goldstein, Classical Mechanics, Addison Wesley.
- F. R. Gantmaĵer, Mecánica Analítica, Ed. URSS, 1996.
- L. Landau y Lifshitz, Mecánica (Curso de Física Teórica, Vol. I), Reverté.
- L. Landau y Lifshitz, Teoría Clásica de Campos, Reverté.
- L. I. Sedov, A course in continuum mechanics, Ed. Walter/Noordhoff, 1971.

COMPLEMENTARY READING

- T. W. Kibble and F. H. Berkshire, Classical Mechanics, Imperial College Press, 2004.
- J. B. Marion, Dinámica clásica de partículas y sistemas, Reverté, 1985.
- A. Fernández-Rañada, Mecánica Clásica, Alhambra Universidad, 1995.
- K. R. Symon, Mecánica, Aguilar
- J. V. José and E. H. Saletan, Classical Dynamics, Cambridge University Press
- E. Levy, Elementos de mecánica del medio continuo, Ed. Limusa-Wiley, 1971.
- S. C. Hunter, Mechanics of Continuos Media, Ed. Ellis Horwood/John Wiley, 1983.
- A. P. French, Vibraciones y Ondas, Reverté.
- M. Spiegel, Mecánica Teórica, McGraw-Hill.
- G. L. Kotkin y V. G. Serbo, problemas de Mecánica Clásica, Mir.
- D. A. Wells, Dinámica de Lagrange, McGraw-Hill.

TEACHING METHODS

- MD01 – Lección magistral/expositiva

- MD03 – Resolución de problemas y estudio de casos prácticos
- MD05 – Seminarios
- MD08 – Realización de trabajos individuales

ASSESSMENT METHODS (Instruments, criteria and percentages)

ORDINARY EXAMINATION DIET

The students will be evaluated on the knowledge acquired both via the presentation of theory or practical problems to be solved individually or in groups, as well as via an individual written exam.
- Presentation of problems to be solved individually or in groups, participation in class: 30% of the final grade.
- Final written exam: 70% of the final grade. **It is mandatory to pass the final exam** to pass the course.

A numerical grading system will be used, in accordance with the article 5 from the R. D 1125/2003, from September 5, which establishes the European system of credits and the grading system in official University degrees valid at the national level. The final grade will result from the weighted average of the different aspects and activities included in the grading system.

EXTRAORDINARY EXAMINATION DIET

Written exam of the course contents, both theory and problems.

SINGLE FINAL ASSESSMENT (evaluación única final)

Those students which, because of work, health, disability, or other justified reasons, cannot follow the ordinary examination diet will have the option of choosing to perform a single final assessment. To do this, they will have to request such option within the first two weeks since the start of the course, or in the first two weeks after registering for the class, if this happened after the start of the classes. They will have to address their application to perform this single final assessment, via the corresponding electronic application form, to the Director of the Department, justifying the reasons they argue to not follow the ordinary examination, as indicated in the Article 6, point 2 and Article 8 of the "Normativa de evaluación y de calificación de los estudiantes de la Universidad de Granada" from November 9, 2016 (http://secretariageneral.ugr.es/bougr/pages/bougr112/_doc/examenes/).
This single final assessment will consist of:
- Written exam of the course contents, both theory and problems.