

26912 - Classical Mechanics I

Syllabus Information

Academic year: 2023/24

Subject: 26912 - Classical Mechanics I

Faculty / School: 100 - Facultad de Ciencias

Degree: 447 - Degree in Physics

ECTS: 7.0

Year: 2

Semester: First semester

Subject type: Compulsory

Module:

1. General information

Classical Mechanics I focuses on one- and two-particle mechanics. It addresses fundamental concepts based on Newton's laws, Hamilton's principle, and the Lagrange and Hamilton equations. It studies particle oscillations, motions in fields of conservative forces such as gravitational and electrostatic, and the calculation of orbits and scattering phenomena. It analyses the two-body problem, introducing concepts of particle systems, and approaches mechanics from non-inertial reference systems and the calculation of forces from the potential created by interacting particles. It is recommended to have taken the subjects Fundamentals of Physics I and II, Physics Laboratory, Mathematical Analysis, Differential Calculus and Computer Science.

The learning activities planned in this subject will contribute to the achievement of SDG 4: Quality Education, of the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030.

2. Learning results

- Identify the main elements describing free and damped oscillations and resonance phenomena.
- Solve one- and two-body mechanical problems using both Newtonian and LaGrange formulations
- Solve the types of orbits in Kepler's problem.
- Describe the phenomena of particle dispersion.
- Solve problems of collisions between two particles.
- Identify the main terms of the equation of motion in accelerated reference frames.

3. Syllabus

- Principles of Mechanics. Newton's Laws. Lagrange equations. Hamilton's equations.
- Oscillatory motion of a particle.
- Conservative central forces. Orbits and dispersion.
- The two-body problem. Collisions.
- Non-inertial reference systems.
- Potential theory.
- Lab session 1: Gravitational field. Orbits.
- Lab session 2: Particle scattering by a central force field.

4. Academic activities

- **Theoretical and practical classes:** 5 theoretical credits and 1.5 credits of problem solving. The days, hours and the classroom will be assigned by the Faculty of Science.
- **Laboratory practices:** 0.5 credits. The dates will be fixed at the beginning of the semester according to the number of students enrolled and the availability of the laboratories.
- **Examinations:** The written exam will have a duration of 4 hours. It will be held on the date indicated by the

5. Assessment system

Laboratory practices: 20% of the grade.

- The students must submit a written report of the laboratory sessions carried out, with the analysis and interpretation of the data.
- Each report will be graded from 0 to 10.
- In order to pass this activity, the student must have submitted all the reports and obtain an average grade of at least 5 points.

Continuous evaluation 10% of the grade.

- It will be evaluated based on the participation in the resolution of problems in class and the completion of a practical work on the contents of the subject
- Its completion is optional for the student.
- If a student does not want to have access to this continuous assessment, in the global computation of the subject the exam test will be worth 80% instead of 70%

Exam: 70% of the grade.

- It will be a written exam, to be held on the dates set by the faculty for the single comprehensive test.
- The exam will have two different parts: theoretical questions and problems, each of which will be graded out of 10.
- Students will be required to respond briefly and reasonably to questions about concepts and phenomena carry out small demonstrations and solve practical cases of brief mathematical resolution and/or of the type of those solved in class during the term.
- The exam will be graded from 0 to 10.
- In order to pass the subject, it will be necessary to achieve a minimum grade of 3 points in each one of the parts (theoretical questions and problems) and a grade of 4 in the average of this exam.