

27038 - Celestial Mechanics

Syllabus Information

Academic year: 2023/24

Subject: 27038 - Celestial Mechanics

Faculty / School: 100 - Facultad de Ciencias

Degree: 453 - Degree in Mathematics

ECTS: 6.0

Year: 4

Semester: Second semester

Subject type: Optional

Module:

1. General information

Optional subject in which *real* orbital motion (perturbed Keplerian model) of celestial bodies is studied in depth; to this end (apart from the already known Newtonian formulation of mechanics used in the subject Mathematical Astronomy), fundamental and more advanced concepts and resources pertaining to analytical dynamics (Lagrangian and Hamiltonian formulations of dynamics) are introduced and applied.

In order to gain a deeper insight into these issues, these two subjects (Mathematical Astronomy and Celestial Mechanics, making up the thematic block Astrodynamics) should be successively taken.

The approaches and objectives of this module are not aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda; in fact the learning activities have nothing to do with the purpose of contributing to some extent to the achievement of the said Goals.

2. Learning results

- Knowing the physical laws governing the motion of natural and artificial celestial bodies (planets, satellites, etc.) and their mathematical formalization, as well as some analytical and numerical techniques applied to the treatment of the differential equations by means of which those laws are mathematically expressed.
- Understanding the different perturbing forces acting on natural celestial objects and on artificial satellites and space probes.
- Knowing Hamiltonian dynamics as the theoretical framework to establish and treat the differential equations of motion under different types of perturbations.

3. Syllabus

- Motion in a central force field.
- Analytical dynamics: Lagrangian and Hamiltonian formulation.
- Orbital perturbations.

4. Academic activities

Master classes: 40 hours.

Problem solving: 20 hours.

Study: 84 hours.

Assessment tests: 6 hours.

5. Assessment system

Throughout the academic period of classroom lectures the student's performance and achievements will be assessed by means of a process of continuous assessment based on a series of tasks involving the detailed written solution of exercises and problems and the oral presentation of some academic works. Student's active participation during the lectures will also be considered.

The detailed written solution of exercises, problems and works handed in by the students will be separately revised and commented by the teacher with each student, in individual sessions of revision, once students have completed their handing in of the tasks proposed during the period of lectures.

Up to 60% of the final grade can be obtained in a written examination at the end of the academic period (after finishing the usual period of lectures). This percentage might be reduced by carrying out some additional academic works, depending on the interest and previous performance of the student, and on the quality and rigor of the results throughout the continuous assessment process.

In any case, the student has the right to pass the subject by means of a unique global written examination. The written test is a conventional exam of practical contents. During this exam teaching resources (books, lecture notes, etc.) can be used. The degree of difficulty of this test is similar to that of the problems and exercises solved throughout the period of lectures.